

Claims

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1. A method of selecting, for a block of a first image based on an array of pixels, a similar block of a second image based on said array of pixels, the method including:
  - 5 (i) defining a reference pixel of said array;
  - (ii) defining a plurality of search zones in said array, labelled by integer index i, each search zone surrounding the reference pixel and any said search zone having a lower value of i;
  - (iii) for successive zones, and for successive pixels in each zone, determining
    - 10 a block of the second image based on the pixel, and determining a mismatch value between said block of the first image and said determined block based on a mismatch criterion; and
    - (iv) selecting said similar block of the second image as the determined block for which said determined mismatch value is lowest,
  - 15 wherein, if a predetermined termination criterion is met, the search terminates and, among said determined blocks of the second image, the determined block having the minimum mismatch value is selected.
2. A method according to claim 1 in which said termination criterion is that a block of the second image is determined for which the mismatch value is
  - 20 below a first threshold.
3. A method according to claim 1 in which the termination criterion is that a mismatch value has been determined for all pixels of a given zone, and for at least one pixel of that zone the mismatch value is below a first threshold
4. A method according to claim 1 in which said termination criterion is that
  - 25 a block of the second image is determined for which the mismatch value is

below a second threshold, and after determining that block, no block of the second image is found having a lower value of the mismatch value within the next  $n$  zones, where  $n$  is a predetermined integer.

- 5     5. A method of selecting, for a block of a first image based on an array of pixels, a similar block of a second image based on said array of pixels, the method including:

(i) defining a reference pixel of said array;

- 10     (ii) defining a plurality of search zones in said array, labelled by integer index  $i$ , each search zone surrounding the reference pixel and any search zone having a lower value of  $i$ ;

(iii) for successive zones, and for successive pixels in each zone, determining a block of the second image based on the pixel, and determining a mismatch value between said block of the first image and said determined block based on a mismatch criterion; and

- 15     (iv) selecting said similar block of the second image as the determined block for which said determined mismatch value is lowest;

wherein said reference point is determined based on:

a previously-derived motion vector for each of one or more further blocks of the first image adjacent to said block of the first image, and

- 20     a previously-derived motion vector of a block of a third image corresponding to said block of the first image.

6. A method of selecting, for a block of a first image based on an array of pixels, a similar block of a second image based on said array of pixels, the method including:

(i) defining a reference pixel of said array;

(ii) defining at least one search zone in said array, labelled by integer index  $i$ , each  $i$ -th zone being composed of pixels for which the sum of the absolute vertical position difference ( $y$ ) in between that pixel and the reference pixel and the absolute horizontal position difference ( $x$ ) between that pixel and the reference pixel is equal to  $i$ ;

(iii) for successive zones, and for successive pixels in each zone, determining a block of the second image based on the pixel, and determining a mismatch value between said block of the first image and said determined block based on a mismatch criterion; and

(iv) selecting said similar block of the second image as the determined block for which said determined mismatch value is lowest.

7. A method of selecting, for a block of a first image based on an array of pixels, a similar block of a second image based on said array of pixels, the method including:

(i) defining a reference pixel of said array;

(ii) defining at least one search zone in said array, labelled by integer index  $i$ , each  $i$ -th zone being composed of pixels for which the absolute vertical position difference ( $y$ ) in between that pixel and the reference pixel and the absolute horizontal position difference ( $x$ ) between that pixel and the reference pixel is given by  $ax^k + by^k = 1$ , where  $a$  and  $b$  are positive predetermined constants and  $k$  is a positive number less than 1;

(iii) for successive zones, and for successive pixels in each zone, determining a block of the second image based on the pixel, and determining a mismatch value between said block of the first image and the determined block based on a mismatch criterion; and

(iv) selecting said similar block of the second image as the determined block for which said determined mismatch value is lowest.

8. A method of selecting, for a block of a first image based on an array of pixels, a similar block of a second image based on said array of pixels, the method including:

(i) defining a reference pixel of said array;

(ii) deriving a search window in the array, the window having a size according to a size parameter;

(iii) defining at least one search zone in said window, labelled by integer index  $i$ , said zones surrounding said reference pixel and having a radius which increases for increasing  $i$ ;

(iv) for successive zones, and for successive pixels in each zone, determining a block of the second image based on the pixel, and determining a mismatch value between said block of the first image and said determined block based on a mismatch criterion; and

(v) selecting said similar block of the second image as the determined block for which said determined mismatch value is lowest.

9. A method of selecting, for a block of a first image based on an array of pixels, a similar block of a second image based on said array of pixels, the method including:

(i) defining a first reference pixel of said array;

(ii) defining at least one first search zone in said array, labelled by integer index  $i$ , the zones surrounding the reference pixel and having a radius which increases for increasing  $i$ ;

(iii) for successive zones, and for successive pixels in each zone, determining a block of the second image based on said pixel, and determining a mismatch value between said block of the first image and said determined block based on a mismatch criterion;

5 (iv) determining at least one second reference pixel of the second image as a pixel for which said determined mismatch value is lowest;

(v) defining at least one second search zone in said array, labelled by integer index  $j$ , surrounding the second reference pixel;

10 (vi) for successive second zones, and for successive pixels in each second zone which are not part of any of said first zones, determining a block of the second image based on said pixel, and determining a mismatch value between said block of the first image and said determined block based on a mismatch criterion; and

15 (vii) selecting said similar block of the second image as the determined block for which said determined mismatch value is lowest.

10. A method of selecting, for a block of a first image based on an array of pixels, a similar block of a second image based on said array of pixels, the method including:

(i) defining a reference pixel of said array;

20 (ii) defining  $N$  search zones in said array, labelled by integer index  $i$ ,  $i=1, \dots, N$ , said zones surrounding said reference point and having a radius which increases for increasing  $i$ ;

(iii) for successive zones, and for successive pixels in each zone, determining a block of the second image based on said pixel, and determining a mismatch

value between said block of the first image and said determined block based on a mismatch criterion; and

(iv) determining said similar block of the second image as the determined block for which said determined mismatch is lowest;

- 5 wherein step (iii) is terminated upon determining that for all pixels in the zone for which  $i=2$ , said determined mismatch is greater than the determined mismatch of a pixel in the zone  $i=1$  of the reference pixel.

11. A method of selecting, for a block of a first image based on an array of pixels, a similar block of a second image based on said array of pixels, the method including:
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(i) defining a plurality of reference pixels of said array, each said reference pixel being a respective prediction of the location of said similar block;

(ii) for each said reference pixel, defining at least one search zone in said array in relation to said reference pixel;

- 15 (iii) for each said reference pixel, for successive zones, and for successive pixels in each zone, determining a block of the second image based on the pixel, and determining mismatch value between said block of the first image and the determined block based on a mismatch criterion; and

- (iv) selecting said similar block of the second image as the determined block for which said determined mismatch value is lowest.
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12. A method of selecting, for a first block of a first image based on an array of pixels, a similar block of a second image based on said array of pixels, the method including:

(i) defining a reference pixel of said array;

(ii) deriving at least one threshold value;

(iii) defining at least one search zone in said array, labelled by integer index  $i$ , said zones surrounding said reference pixel and having a radius which increases for increasing  $i$ ;

5 (iv) for successive zones, and for successive pixels in each zone, determining a block of the second image based on said pixel, and determining a mismatch value between said first block of the first image and said determined block based on a mismatch criterion; and

10 (v) selecting said similar block of the second image as the determined block for which said determined mismatch is lowest;

wherein step (iv) is terminated upon at least one termination criterion being satisfied, said termination criterion being defined in terms of a respective said threshold value.

13. A method according to claim 12 in which in step (ii) said at least one threshold value is determined based on a previously-derived minimum mismatch value for at least one further block of the first image adjacent said first block of the first image.

14. A method of selecting, for a block of a first image based on an array of pixels, a similar block of a second image based on said array of pixels, the method including:

(i) defining a reference pixel of said array;

(ii) deriving a zone number,  $M$ ;

20 (iii) defining in said array a number of zones equal to said zone number, said zones being labelled by an integer index  $i=1, \dots, M$ , said zones surrounding said reference pixel and having an increasing radius for increasing  $i$ ;

(iv) for successive zones, and for successive pixels in each zone, determining a block of the second image based on said pixel, and determining a mismatch value between said block of the first image and said determined block based on a mismatch criterion; and

- 5 (v) selecting said similar block of the second image as the determined block for which said determined mismatch value is lowest.

15. A method of selecting, for a first block of a first image based on an array of pixels, a similar block of a second image based on said array of pixels, the method including:

- 10 (i) defining a reference pixel of said array;
- (ii) deriving at least one threshold value based on a mismatch value of a second block of the first image adjacent said first block;
- (iii) defining at least one search zone in said array, labelled by integer index  $i$ , said zones surrounding said reference pixel and having a radius which
- 15 increases for increasing  $i$ ;
- (iv) for successive zones, and for successive pixels in each zone, determining a block of the second image based on said pixel, and determining a mismatch value between said block of the first image and said determined block based on a mismatch criterion; and
- 20 (v) selecting said similar block of the second image as the determined block for which said determined mismatch value is lowest;

wherein step (iv) is terminated upon at least one termination criterion being satisfied, said termination criterion being defined in terms of a respective said threshold value.

16. A method of encoding a first image which includes defining successive blocks of the first image, and for each block of the first image:

selecting a similar block of a second image by a method according to claim 1;

5 encoding the block of the first image as data specifying the similar block of the second image, and the data specifying differences between the block of the first image and the similar block of the second image.

17. A method of encoding a first image which includes defining successive blocks of the first image, and for each block of the first image:

10 selecting a similar block of a second image by a method according to claim 5;

encoding the block of the first image as data specifying the similar block of the second image, and the data specifying differences between the block of the first image and the similar block of the second image.

15 18. A method of encoding a first image which includes defining successive blocks of the first image, and for each block of the first image:

selecting a similar block of a second image by a method according to claim 6;

20 encoding the block of the first image as data specifying the similar block of the second image, and the data specifying differences between the block of the first image and the similar block of the second image.

19. A method of encoding a first image which includes defining successive blocks of the first image, and for each block of the first image:

selecting a similar block of a second image by a method according to claim 7;

encoding the block of the first image as data specifying the similar block of the second image, and the data specifying differences between the block of the first image and the similar block of the second image.

20. A method of encoding a first image which includes defining successive blocks of the first image, and for each block of the first image:

selecting a similar block of a second image by a method according to claim 8;

encoding the block of the first image as data specifying the similar block of the second image, and the data specifying differences between the block of the first image and the similar block of the second image.

21. A method of encoding a first image which includes defining successive blocks of the first image, and for each block of the first image:

selecting a similar block of a second image by a method according to claim 9;

encoding the block of the first image as data specifying the similar block of the second image, and the data specifying differences between the block of the first image and the similar block of the second image.

22. A method of encoding a first image which includes defining successive blocks of the first image, and for each block of the first image:

selecting a similar block of a second image by a method according to claim 10;

encoding the block of the first image as data specifying the similar block of the second image, and the data specifying differences between the block of the first image and the similar block of the second image.

23. A method of encoding a first image which includes defining successive  
5 blocks of the first image, and for each block of the first image:

selecting a similar block of a second image by a method according to claim 11;

- 10 encoding the block of the first image as data specifying the similar block of the second image, and the data specifying differences between the block of the first image and the similar block of the second image.

24. A method of encoding a first image which includes defining successive blocks of the first image, and for each block of the first image:

selecting a similar block of a second image by a method according to claim 12;

- 15 encoding the block of the first image as data specifying the similar block of the second image, and the data specifying differences between the block of the first image and the similar block of the second image.

25. A method of encoding a first image which includes defining successive blocks of the first image, and for each block of the first image:

- 20 selecting a similar block of a second image by a method according to claim 14;

encoding the block of the first image as data specifying the similar block of the second image, and the data specifying differences between the block of the first image and the similar block of the second image.

26. A method of encoding a first image which includes defining successive blocks of the first image, and for each block of the first image:

selecting a similar block of a second image by a method according to claim 15;

5 encoding the block of the first image as data specifying the similar block of the second image, and the data specifying differences between the block of the first image and the similar block of the second image.

27. A computer-readable medium storing computer-executable program code for performing a method according to claim 1, whereby execution of the  
10 code by a processor causes the processor to select a block of the second image.

28. A computer-readable medium storing computer-executable program code for performing a method according to claim 5, whereby execution of the  
15 code by a processor causes the processor to select a block of the second image.

29. A computer-readable medium storing computer-executable program code for performing a method according to claim 6, whereby execution of the code by a processor causes the processor to select a block of the second image.

20 30. A computer-readable medium storing computer-executable program code for performing a method according to claim 7, whereby execution of the code by a processor causes the processor to select a block of the second image.

25 31. A computer-readable medium storing computer-executable program code for performing a method according to claim 8, whereby execution of the

code by a processor causes the processor to select a block of the second image.

32. A computer-readable medium storing computer-executable program code for performing a method according to claim 9, whereby execution of the code by a processor causes the processor to select a block of the second image.

33. A computer-readable medium storing computer-executable program code for performing a method according to claim 10, whereby execution of the code by a processor causes the processor to select a block of the second image.

34. A computer-readable medium storing computer-executable program code for performing a method according to claim 11, whereby execution of the code by a processor causes the processor to select a block of the second image.

35. A computer-readable medium storing computer-executable program code for performing a method according to claim 12, whereby execution of the code by a processor causes the processor to select a block of the second image.

36. A computer-readable medium storing computer-executable program code for performing a method according to claim 14, whereby execution of the code by a processor causes the processor to select a block of the second image.

37. A computer-readable medium storing computer-executable program code for performing a method according to claim 15, whereby execution of the code by a processor causes the processor to select a block of the second image.

38. A digital video encoder comprising:

block definition means to define successive blocks of the first image:

block selection means which, for each block of the first image, selects a similar block of a second image; and

5 means for encoding the block of the first image as data specifying the similar block of the second image, and the data specifying differences between the block of the first image and the similar block of the second image;

10 wherein the block selection means selects the similar block of the second image by:

(i) defining a reference pixel of said array;

(ii) defining a plurality of search zones in said array, labelled by integer index  $i$ , each search zone surrounding the reference pixel and any said search zone having a lower value of  $i$ ;

15 (iii) for successive zones, and for successive pixels in each zone, determining a block of the second image based on the pixel, and determining a mismatch value between said block of the first image and said determined block based on a mismatch criterion; and

20 (iv) selecting said similar block of the second image as the determined block for which said determined mismatch value is lowest,

and the block selection means is arranged to detect whether a predetermined termination criterion is met, and if it is the block selection means terminates the search and selects the block of the second image among said determined blocks of the second image, as the determined block having the minimum  
25 mismatch value.